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THE  
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PULSES OF INDIA.

(ASSAM VALLEY PULSES.)

[ *Dictionary of Economic Products*, Vol. VI., Pt. I., P. 1410-25. ]

Other **DICTIONARY** articles that may be consulted :

*Cajanus indicus*, Vol. II., C. 49-57.  
*Dolichos biflorus*, Vol. III., D. 758-88.  
*Glycine hispida*, Vol. III., G. 263-70.  
*Lathyrus sativus*, Vol. IV., L. 100-9.  
*Lens esculenta*, Vol. IV., L. 252-65.  
*Phaseolus Mungo*, Vol. VI., Pt. I., P. 496-522.  
*Pisum arvense*, Vol. VI., Pt. I., P. 882-4.

THE CULTIVATION OF PULSE CROPS IN THE ASSAM VALLEY.

By MR. B. C. BASU, Assistant to the Director, Department of Land Records and Agriculture, Assam.

*Kinds of Pulse Grown.*

The following kinds of pulse are grown in the Assam Valley, named in order of importance :—

- (1) *Māti-māh* (*Phaseolus Mungo* var. *radiatus*).
- (2) *Magu-māh* (*P. Mungo*).
- (3) *Kālā-māh* or *khesari* (*Lathyrus sativus*).
- (4) Lentil or *masur-māh* (*Lens esculenta*, syn. *Ervum Lens*).
- (5) Peas or *matar-māh* (*Pisum arvense*).
- (6) Horse gram or *kulthi-māh* (*Dolichos biflorus*).
- (7) *Rahar-māh* (*Cajanus indicus*).
- (8) *Bejia-māh* (*Pueraria phaseoloides*).
- (9) Soy-bean or *pātani jokrā* (*Glycine hispida*, syn. *G. Soja*).

Besides the foregoing, the ripe seeds of several species of creeper bean, such as the Indian butter bean (*Dolichos Lablab*, Ass.

Assam sorts  
of pulse  
cultivated.

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## PULSES.

## The Cultivation of Pulse Crops

FIELD  
PULSES.

*urahi*), the Asparagus bean (*Vigna Catjang*, Ass. *lecherd-mdh*), and the Lima bean or *katdri-dabud-mdh* (*Phaseolus lunatus*), are occasionally used as pulse or *ddl*, but since these beans are grown as garden crops mainly for use as vegetables, it is not proposed to deal with their cultivation here. A description of field pulses alone is attempted in this note.

Among the pulses grown in the Assam Valley *mdti-mdh*\* occupies the foremost place. It forms one of the staple crops of the province, ranking in importance next to rice and mustard, if we except tea which is outside the scope of ordinary cultivation. The special crop statistics do not show separately the areas annually cropped with different pulses, but it can be safely said that not less than 90 per cent. of the total area so cropped is occupied by *mdti-mdh* alone. The following were the aggregate areas in 1901-1902 occupied by all kinds of pulse in the five upper districts of the Assam Valley, for which we possess complete statistics:—

Area under  
cultivation.

District.	Total cropped area, excluding tea and coffee.	Total area under all pulses.	Percentage of col. (3) on col. (2).
1	2	3	4
	Acres.	Acres.	
Kamrup . . . . .	489,151	20,173	4.1
Nowgong . . . . .	203,592	16,377	8.0
Darrang . . . . .	247,024	11,853	4.8
Sibsagar . . . . .	423,137	15,985	3.8
Lakhimpur . . . . .	171,047	5,832	3.4
TOTAL . . . . .	1,533,951	70,220	4.6

The cultivation of pulses reaches its maximum in Nowgong, where these are extensively grown in the large *chapari* tract lying between the Kalang and the Brahmaputra. The bulk of the area cropped with pulses is found in the flooded alluvial flats bordering on the Brahmaputra river and on its principal tributaries. In the higher-lying permanently cultivated tracts, pulses are grown more or less in almost every village, but the crops are generally poor. Further inland, along the foot of the hill ranges, the country is inhabited by Kacharis, Mikirs, and other non-Hindu tribes, for whom pulses do not possess much attraction, and by whom they are little grown.

\* *Mdh* is the generic name for all kinds of pulse. The word is derived from Sanskrit *māshā*, after which the Indian jeweller's weight *māshā* is named.

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<p style="text-align: center;"><b>MÁTI-MÁH.</b></p> <p style="text-align: center;"><b>(Phaseolus Mungo, Linn. var. radiatus, Linn.)</b></p> <p>Bengali—<i>Máshkaldí.</i> Hindi—<i>Urd.</i></p> <p><b>Varieties.</b>—There are two well-recognised varieties of this pulse. The ordinary kind or <i>mdti-mdh</i> proper, also known as <i>kali-mdh</i>, has black seeds, and a second variety known as <i>kapau-mdh</i> কপৌমধ (other names are <i>rdng-dengid-mdh</i> and <i>deuri-mdh</i>) has yellowish green seeds, a little larger than those of the former. The latter variety seems to be an intermediate form between <i>mdti</i> and <i>magu mdh</i>; the leaves are of a lighter colour, and the pods lack the central dark stripe, which characterises the black variety; the grain is also considered better eating than the black kind. A sub-variety of <i>kali-mdh</i> is known as <i>chungi-mdh</i>, which is distinguished by the pods being turned upwards and the close compact growth of the plant unlike the spreading habit of the ordinary form of the <i>kali</i> variety, which is also known as <i>latd mdti-mdh</i>. The different kinds are ordinarily grown together, the cultivators showing no preference for any particular kind; but <i>kapau-mdh</i> is sometimes grown singly. The rains variety of <i>urd</i>, which is grown in Bengal and the United Provinces of Agra and Oudh is not known in Assam, the climate being perhaps too wet to allow it to come to maturity.</p> <p><b>Distribution and kind of Land and Soil on which it is ordinarily grown.</b>—As stated above, <i>mdti-mdh</i> is grown more or less in every part of the Assam Valley, but it is principally cultivated in the loamy alluvial tracts or <i>chaparis</i>, as they are called, on both banks of the Brahmaputra river and its main tributaries. For <i>mdti-mdh</i> the most productive lands are naturally those which annually receive a deposit of silt or are newly reclaimed from forest. It is, however, absolutely necessary that the land should get sufficiently dry by the end of September, which is considered the latest date for sowing the crop. In the higher country removed from the influence of the annual floods, <i>mdti-mdh</i> is ordinarily grown as a second crop after rice seedlings and early rice, and also in fields that have borne a sugar-cane crop in the previous year. Rice seedlings (<i>kathid</i>) like sugar-cane (<i>gdnthid</i>) and the <i>dthid</i> plantain are believed to be exhausting crops, the three being named together in the pithy saying—“<i>বানিষ কঠিষ গণিষ</i>” (<i>dthid kathid gdnthid</i>). The succeeding pulse crop is never expected to give a good yield, but intelligent cultivators believe in its ability to improve the fertility of the soil; this belief may have influenced the custom of taking a pulse crop after sugar-cane and rice seedlings. Loamy soils are considered</p>	<p><b>CULTIVATION IN ASSAM.</b></p> <p><b>PHASOLUS MUNGO var. RADIATUS.</b></p> <p><b>Varieties.</b></p> <p><b>Distribution.</b> Soil.</p>

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PULSES.	The Cultivation of Pulse Crops
PHASEOLUS MUNGO var. RADIATUS.	the best for <i>mdti-mdh</i> , and of such soils there is no lack on the extensive <i>chaparis</i> abutting on the Brahmaputra river.
Alternative crops.	<p><b>Rotation.</b>—There is no well-recognised system of rotation followed in regard to this pulse, but on lands which are annually cropped with rice seedlings (<i>kathiā toli</i>), <i>mdti-mdh</i> is commonly taken as a secondary crop year after year. In <i>chapari</i> lands, which are abandoned after two or three years of cultivation, <i>mdti-mdh</i> is taken if the land gets dry in time as first or the last crop in the well-known rotation under which <i>dhu</i> and mustard are grown. In convenient situations it may be grown for one or more years after the rotation proper has ceased. In land covered in the natural state with <i>ulu</i> grass, the usual thing is to break it up in August and September, and take <i>mdti-mdh</i> as the first crop before commencing the rotation of <i>dhu</i> and mustard.</p>
Cultivation.	<p><b>Cultivation.</b>—The cultivation of this pulse is of the scantiest description as is well indicated by the country proverb :—</p> <p style="text-align: center;">“ নাহে কয় পার যদি চহাবি নোঁবাবো যদি ঝঁহাবি ”</p>
	<p><i>i.e.</i>, says <i>mdh</i>—plough if you can, if not, scratch.</p> <p>Two ploughings are the usual rule, but in hard soil, as many as four may be required. The land is left in lumps and never harrowed. Too much cultivation and a fine tilth are apt to encourage excessive growth of foliage at the cost of the yield of grain. This fact indicates, I think, the poverty of the Assam soil in some of the mineral ingredients of plant food, probably potash and phosphoric acid, which are necessary for seed formation. In <i>chaparis</i>, if it be intended to take pulse as the first crop of the rotation, the land has to be cleared of grass or reed jungle before it can be ploughed. It is not an uncommon practice to scatter <i>mdti-mdh</i> broadcast among rice stubble, or even among standing <i>sālī</i> rice when the soil is still somewhat soft, in the same way as <i>khesdri</i> is ordinarily sown. This method of cultivation obtains chiefly in Nowgong, Kamrup, and Mangaldai, but not to any great extent. It is resorted to only when the rice crop fails. A more common practice is to sow <i>mdti-mdh</i> broadcast on the soft silt left by the floods, if the land is found to be free from jungle. In such cases, no cultivation whatsoever is necessary. Manuring is considered wholly unnecessary for this crop. The people, on the other hand, rightly believe in its power of improving the condition of the land, and on poor exhausted lands they grow it as much for this sake as for the sake of its produce.</p>
Sowing season.	<p><b>Sowing.</b>—The season for sowing <i>mdti-mdh</i> may be said roughly to coincide with the month of September (from 15th <i>Bhādra</i> to 15th <i>P.</i> 1410-25.</p>

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CULTIVATION  
IN ASSAM.

*Aswin*); in high village lands the sowing must be finished by the middle of September; in *chapari* the season may extend to the middle of October, but late-sown crops do not seed well. The best time for sowing is said to be the last four days of *Bhādra* and the first four days of *Aswin*, as inculcated in the proverb, which runs as follows:—

ভাদৰ চাৰি, অহিনৰ চাৰি।  
মহে বোকা যিমান পাৰি॥

and translates thus:—Sow *māh* as much as you can during (the last) four days of *Bhādra* and (the first) four days of *Aswin*.<sup>\*</sup> The quantity of seed sown varies from 6 to 9 seers per acre, according as the sowing is early or late. Thick sowing is discountenanced, as it prevents the plants which come up thickly from spreading and attaining proper growth. The necessity for thin seeding is indicated in the following proverb:—

“খন সৰিহ পাতল মাহ।  
বগুৰ তলত চৰে হাঁহ॥”

*i.e.*, mustard should be sown thick; *māh* thin; ducks (should be able to) graze under *migu*. The seed is scattered broadcast and harrowed into the soil. On high village lands *māti-māh* is always grown as a single crop, and such is also the case in *chapari* in Upper Assam; in Lower Assam it is occasionally mixed with *khasri* and peas.

**Harvesting.**—The crop receives no other treatment before harvesting. It remains on the ground for about four months. In the drier village lands, it comes to maturity earliest, and seldom remains on the ground longer than three months and a half; in *chapari* lands, where the soil is more moist, the plant remains green longer and takes almost four months and a half to mature properly. *Māti-māh* is not much liable to shed in the field, and is gathered in at leisure. The harvesting season extends from the end of November to the middle of February, but the bulk of the crop is got in by the first half of January. The plants are simply pulled up by the roots and left to dry in the field from a week to a fortnight according to the state of the weather and the convenience of the cultivator. They are then collected into bundles and brought into the threshing floor. The threshing is ordinarily done by cattle in the same way as for paddy. *Māti-māh* is rather difficult to thresh, as the grains do not separate readily from the pods. To expedite the threshing, a man goes on beating the mass on the floor with a stick all the time the

Season of  
harvesting.

\* Another and more plausible interpretation of the proverb is—“Sow *māh* during *Bhādra* and *Aswin* after excluding the first four days of the former and the last four days of the latter”.

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## The Cultivation of Pulse Crops

PHASEOLUS  
MUNGO var.  
RADIATUS.

cattle are going round—an operation which has given rise to the following saying:—

“বাহর হ'ল বেৰি তিলে বেত বেলে।”

i.e., the sesamum opens its lips on seeing how *mdh* is beaten. After threshing, the grain is winnowed and freed from chaff in the ordinary way.

Weather.  
Diseases.  
Injuries.

**Weather, Diseases and Injuries.**—Light rain during growth is considered beneficial, but the crop is injured by rain at blossoming time, after which the weather should be quite dry. Heavy rain immediately after sowing causes the seed to rot in the ground and is injurious to the crop at every stage. In *chapari* tracts if the flood is late in subsiding, the area available for pulse-sowing is necessarily curtailed.

The *mdli-mdh* crop is liable to several kinds of insect pests:—A nocturnal caterpillar known in Upper Assam as *surpokd* does much injury by cutting down the stems. It is probably the caterpillar of a *Noctues* moth allied to the species which injures seedlings of cabbage, brinjal and other garden crops. A plague of caterpillars, which the people speak of as *bichhdbdn* (বিছবিদ্বান), appeared in 1900 in North Kamrup and ate up almost the entire crop of pulse, and caused much mischief also to mustard, tobacco and garden crops. On old exhausted village lands, and occasionally on *chapari* lands also, *mdli-mdh* suffers from a disease locally known as *khdr-uthd* (খারউঠা) (literally Alkali-rising), also called *khdre-dhard*, small patches here and there drying up in the midst of a thriving crop. Heavy rain or excessive dampness of soil is the cause of this disease. The crop is also infested with a red mildew called *rangoli* (also known as *rangd-pard*, *child-reg* or *swarag-pard*), but it does little harm. This last disease also affects rice and other crops.

Yield.

**Outturn.**—The average\* of 2,133 crop cuttings made with this crop extending over a period of 16 years gives an outturn per acre of 467 lbs., or about 6 maunds of pulse. The real average may not be far removed from this figure. On the rich annually fertilised *chapari* lands, very good yields rising as high as 12 maunds per acre can be obtained, but on the poorer and impoverished village lands, the yield is generally very poor, and an outturn of 3 maunds to the acre would be considered a good crop.

Storing.

**Storage.**—There is no special way of storing the pulse when required for food, but seed pulse is usually kept in what are called *topus* or *lomes* made of thin bamboo slips woven in a roughly globular shape. These are inlaid with straw and plastered outside with a

\*The average is for the whole province, but the great majority of the experiments were made in the five districts of Assam proper.

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mixture of cowdung and mud with a view to keep out damp and insects. This method of preserving seed is common to every kind of food-grain grown in the Assam Valley.

**Trade and Prices.**—There is no export trade in any kind of pulse grown in the Assam Valley, the local production being insufficient for the requirements of the people. A large proportion of the population is composed of foreigners, who are great consumers of *ddl*, and for whom a large quantity of pulse of different sorts has to be annually imported from outside the province. The total quantity of pulse imported into the Brahmaputra Valley in 1901-1902 was 273,559 maunds = 9,192 tons.

There is very little internal trade in *mdti-mdh* or any other pulse within the province, as the bulk of the crop is consumed where it is grown. There is some export trade in pulse from the Nowgong and Sibsagar *chafaris* to Gauhati, but in the absence of internal trade registration, I cannot say what the volume of this trade may be.

**Use.**—The main use to which this pulse is put is of course as *ddl*, which is prepared in various ways. It is also used by Hindus as an offering to the gods, for which purpose the grain is steeped in water for a night and then washed to remove the husk. In this state it is called *prashad*, which is eaten uncooked with salt and ginger. *Mdti-mdh* is also in great demand from cartmen as food for their bullocks. It is also sometimes given to milch cows, but the practice is by no means general in this province.

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## Trade.

## Uses.

## MAGU-MDH.

## Phaseolus Mungo, Linn.

English name—The mung pulse.

Hindi—*Mung*.

Bengali and Lower Assam—*Mug*.

Botanically speaking, *magu-mdh* and *mdti-mdh* are mere varieties of one and the same species. The main points of difference between the two consist in the leaves of *mdti-mdh* being darker coloured and these, as well as the pods, being more pubescent than those of *magu-mdh*. *Magu-mdh* is a more delicate plant, and its grain is more tasty than *mdti-mdh* and is consequently more highly prized.

**Varieties.**—Two varieties of *magu-mdh* are grown in Assam:

(1) *Assameti magu*, also called *kali-magu*, having small dark greenish seeds, and (2) *Bengali magu* (also called *sond mukhi*, *bagi*, or *kapau magu*), having larger and greenish yellow seeds. The latter variety resembles the well-known *sond-mug* of Bengal, but the colour is not so bright yellow as in the true Bengal variety.

PHASEOLUS  
MUNGO.

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PHASEOLUS MUNGO.	Among pulses, <i>magu-máh</i> is most esteemed, being considered more wholesome than any other pulse, and also for the sake of its fine flavour.
Distribution.	<b>Distribution.</b> —In Assam its cultivation ranks next in importance to <i>máti-máh</i> . It demands more care than the latter. The crop is chiefly grown in the flooded alluvial country bordering on the Brahmaputra, and seldom on old impoverished village lands such as are ordinarily cropped with <i>máti-máh</i> .
Cultivation.	<b>Cultivation.</b> —The land requires a better tilth and should be ploughed and harrowed oftener than in the case of <i>máti-máh</i> . The quantity of seeds sown is somewhat less than in the case of <i>máti-máh</i> and may be roughly put at 6 seers per acre. The crop matures a week or 10 days earlier than <i>máti-máh</i> and is easier to thresh. In all other respects the two pulses differ but little from one another.
Outturn. Price.	<b>Yield and Price.</b> —The outturn is somewhat smaller, but it is more than made up by the higher prices it commands in the market. The price usually varies from R3 to R5 per maund.
Injuries.	<b>Injuries.</b> —Unlike <i>máti-máh</i> , <i>magu</i> is subject to injury in store by a species of moth, which also infests several other kinds of pulse.
Uses.	<b>Uses.</b> —The uses of <i>magu</i> are very much the same as those of <i>máti-máh</i> , except that it is too valuable to be fed to cattle. Being delicate and easily cooked, it requires no <i>khár</i> or alkali in cooking as in the case of <i>máti-máh</i> .

## KALÁ-MAH.

LATHYRUS SATIVUS.

## Lathyrus sativus, Linn.

English name—Garosse, Gesse.

Bengali and Hindi—*Khesari*.Lower Assam—*Kald*.**Variety.**—Only one variety of this pulse is known in Assam.

Distribution. Soil.

**Distribution and Soil.**—*Kalá* is grown chiefly in Kamrup and Nowgong and the western parts of the Darrang district. In Sibsagar, it is still looked upon as a novelty, its cultivation being practically confined there to the Majuli and to the heavily-flooded mauzas on the south bank of the Brahmaputra river. There are two well-recognised methods of growing this crop. In the first method the crop is grown on low paddy land, the seed being scattered broadcast on the soft muddy soil among the paddy bushes. The second method obtains in the *chapari* tracts, where the land is prepared in the same way as for mustard and other cold weather crops. *Kald-máh* does best, when sown among *sdi* or *báo* paddy on clay soils such as would

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retain moisture through the cold weather. In *chapari* lands the soil is ordinarily of a loamy description, and as a sufficient store of moisture is left in the soil by the annual floods, the crop is seldom liable to suffer from drought. Self sown crops of *kald*, as well as of peas and lentil, are occasionally met with. They continue to crop up for years in situations where the soil is favourable. If the crop is promising, it is looked after and harvested, but, as a rule, such crops are too poor to receive any attention.

**Rotation and Mixtures.**—When sown in low lands *kald* should be regarded as a catch crop after winter rice (*sali* and *bis*), as the land requires no additional cultivation. In *chapari* lands, *kald* is taken as an alternative for mustard in the well-known system of rotation, under which *dhū* is followed by mustard year after year. It then forms the last crop of the rotation. A little peas is always found mixed with *kald* in the field; the two pulses are sown and reaped together, and the cultivators do not think it necessary to separate them. *Kald* is also sown in mixture with mustard, and on rare occasions with *māti-māh*.

Rotatory  
and mixed  
crops.

**Cultivation.**—As previously said, no cultivation whatsoever is necessary when the crop is sown among standing low-land paddy. The same is the case in *chapari* lands when the flood has left a thick deposit of silt and killed the jungle. The general custom, however, in the *chapari* tracts is to give the land from four to six ploughings and three or four harrowings until a sufficiently fine tilth has been attained. The sowing season extends from the 1st of October to the end of November. In low lands, the sowings must be completed by the third week of October, but in the *chaparis*, where the land has to be ploughed, sowings may be continued to the end of November. About 12 to 18 seers of seed is required to sow an acre of land. When sown among paddy, the seeds are previously soaked in water for a night.

Cultivation.

No after-treatment is required beyond fencing in and watching the crop in places where cattle-trespass is feared. A few showers of rain during the period of growth are beneficial to the crop, but rain at blossoming and harvesting time is injurious. The crop is harvested in March and April, i.e., 6 to 7 months after the date of sowing. The harvesting and threshing are done in the same way as with *māti-māh* but the threshing is easier.

The *kali* crop is very little subject to insect pests, but suffers from *khār-ulhā* like *māti* and *magu-māh*.

A yield of 12 maunds per acre would be considered a good ordinary outturn. The maximum yield may reach up to twice this amount. *Kald* is the cheapest pulse grown in Assam, the price obtained by the cultivators in Lower Assam ranging usually from 12 annas to

Yield.

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PULSES.	The Cultivation of Pulse Crops
<b>LENS ESCULENTA.</b>	<p>₹1.8 per maund. In Upper Assam the market price would be about ₹2 per maund.</p>
	<b>MASUR-MÁH.</b>
	<b>Lens esculenta, Moench.</b>
	English—Lentil.
	Bengali and Hindi— <i>Masur</i> .
	<b>Variety.</b> —Only one variety of this pulse is known in cultivation.
	The kind grown in Assam has smaller seeds than the imported kind coming from Upper India.
Distribution. Soil.	<b>Distribution and Soil.</b> —Lentil is grown in the same kind of land as <i>dhu</i> and mustard. Usually it follows a broadcasted <i>dhu</i> crop and is sown in mixture with mustard. Its cultivation is chiefly confined to the <i>chaparis</i> of Kamrup, Nowgong, and Mangaldai. In Upper Assam it is cultivated to a small extent in the Majuli. The crop prefers a light loamy soil and an open situation.
Cultivation.	<b>Cultivation.</b> —The land is prepared for the crop in the same way as for <i>magu-máh</i> and <i>káid</i> . It is sown in the first fortnight of November, and sowing must be completed by the middle of that month. As previously said, lentil is generally sown in mixture with mustard, but it is not uncommon to see it grown as an independent crop. About 6 seers of seeds are required for sowing an acre, when sown with mustard; sown singly about 50 per cent. more seed is required. No after-treatment is necessary.
Injuries.	<b>Injuries.</b> —The crop is singularly free from insect pests, but is subject to <i>khar-utá</i> , to which most kinds of pulse are subject.
Harvesting.	<b>Harvesting.</b> —Lentil is harvested in March and April. It is threshed in the ordinary way, but although the pods are easily separated from the straw, they do not readily yield the seeds and require to be crushed in a mortar and pestle to secure this end.
Outturn.	<b>Yield.</b> —The usual yield of lentil is about 2 to 4 maunds to the acre. The price obtained by the cultivators ranges from ₹2.8 to ₹4 per maund.
Uses.	<b>Use.</b> —It is one of the pulses which is forbidden to Hindu widows, but in Assam the prohibition is confined to Brahman widows alone.
<b>PISUM ARVENSE.</b>	<b>MATAR-MÁH.</b>
	<b>Pisum arvense, Linn.</b>
	English name—Field pea.
	Local name in Mangaldai— <i>Batalid máh</i> .
	Bengali— <i>Matar</i> .
	Hindi— <i>Kerdo</i> .

in the Assam Valley.

(B. C. Basu.)

PULSES.

Peas are seldom raised as an independent crop by Assamese cultivators. The little that they grow occurs in mixture with *kald* (*Lathyrus sativus*) as stated in describing the cultivation of the latter. A separate description of its cultivation will, therefore, be superfluous. Peas are also sown mixed with mustard and *mdti-mdh* pulse. Time-expired coolies who have settled in Assam occasionally grow peas as a single crop, but the extent of such cultivation is very limited. The Assamese variety is of a very inferior description and is no doubt the result of degeneration. The writer has seen excellent samples of peas grown by up-country-men settled at Gauhati and Kamrup on the Assam-Bengal Railway.

CULTIVATION  
IN ASSAM.

**KULTHI-MĀH.**

**Dolichos biflorus, Linn.**

English name—Horse gram.

Assamese synonyms—*Kulthi-mdh*, *kulat-mdh*, *sulti-mdh*, *chepli-mdh*.

Bengali and Hindi—*Kurthi*.

DOLICHOS  
BIFLORUS.

**Distribution.**—*Kulthi-mdh* is grown to a small extent in Kamrup and Darrang. In the Tezpur sub-division it is cultivated by Nepalese and coolie settlers. In Upper Assam and Nowgong, this pulse seems to be quite unknown.

Distribution.

**Cultivation.**—Only one variety is known in Assam. The crop is grown in the same class of village lands as *mdti-mdh*. The method of cultivation and time of sowing and reaping are very much the same for both. About 5 seers of seed are sown per acre; thin seeding is desirable, the object being to allow the plants to creep and spread over ground. A good crop may yield up to 6 maunds of pulse per acre, but I believe the yield is usually very inferior.

Cultivation.

*Kulthi-mah* is also a cheap pulse, though it is seldom procurable in the market.

Preservation.

For preserving the seed, the grain is soaked in urine and then dried up with sand and by exposure to the sun. The seed is then stored either in earthen pots with a layer of sand on the top, or in *tomers* as is done with *mdti-mdh* seed.

The main use of *kulthi* is either as *ddl*, that is, split pulse, or in the form of meal. The grain has a nauseating fishy smell about it, and in either mode of using it, it should be fried before being split or ground into meal. *Khar* or Assamese alkali is added in cooking to soften the pulse.

Uses.

*Kulthi* flour is also used in preparing a kind of native sweetmeat, esteemed as diet for women after confinement. It is considered wholesome and light of digestion.

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PULSES.	The Cultivation of Pulse Crops
CAJANUS INDICUS.	<p data-bbox="543 398 699 421" style="text-align: center;"><b>RAHAR-MÁH.</b></p> <p data-bbox="475 437 767 467" style="text-align: center;"><b>Cajanus indicus, Spreng.</b></p> <p data-bbox="401 478 910 530">Assamese synonyms—<i>Arhar</i>, <i>rahar dól</i>, <i>miri-máh</i>, <i>gáro-máh</i> and <i>gêld-máh</i>.</p> <p data-bbox="401 529 551 552">Bengali—<i>Arahar</i>.</p> <p data-bbox="401 552 527 575">Hindi—<i>Rahar</i>.</p> <p data-bbox="222 583 309 606">Distribution. <b>Distribution.</b>—<i>Rahar</i> is grown in small quantities all over the valley. The usual practice is to grow it as a border crop round the sugar-cane fields, more for the protection of the cane crop than for the sake of its seeds. The stems are also utilized as fuel for boiling the cane juice. The plants are left to themselves and allowed to remain as long as they live. The Assamese think so little of the crop that they seldom take the trouble to gather the pods. As a field crop, <i>rahar</i> is seldom found in Assam except in small patches raised by coolie settlers. It is then treated as an annual crop. The variety so grown is probably distinct from the native variety grown by Assamese as a hedge crop.</p> <p data-bbox="222 857 309 901">Lac insect reared on the plant. <b>Synonyms.</b>—<i>Rahar</i> is known by various names in the province. It is often spoken as <i>miri-máh</i> in Upper Assam and <i>gáro-máh</i> in the Lower districts, from the fact that it is one of the trees on which the Garos and the Miris rear the lac insect. Its name <i>gêld-máh</i> is derived from the fact that the pulse acquires a very soft consistency when boiled as <i>dól</i>.</p> <p data-bbox="222 1001 309 1024">Cultivation. <b>Cultivation.</b>—The usual time for sowing is April and May. When grown around sugar-cane, the seeds are dibbled into the soil on the ridges enclosing the field. In field cultivation, the crop is sown in mixture with <i>dhu</i> rice or millets. The crop receives no further treatment. The pods ripen in March and April.</p> <p data-bbox="222 1130 309 1174">Grown around sugar-cane. <b>Variety.</b>—The Assamese <i>rahar</i> is considered as inferior in flavour and taste to the imported kind, and does not cook so soft as the latter. It is believed that Assam-grown <i>rahar</i> is apt to cause giddiness, if eaten too often.</p>
PUERARIA PHASEOLOIDES.	<p data-bbox="549 1254 691 1277" style="text-align: center;"><b>BEJIA-MÁH.</b></p> <p data-bbox="434 1293 802 1323" style="text-align: center;"><b>Pueraria phaseoloides, Benth.</b></p> <p data-bbox="330 1338 910 1462">This is a peculiar variety of pulse, which is perhaps not cultivated out of the Assam Valley, and even here it is far from being generally known. It is found in certain parts of North Kamrup and the Darrang district. The plant greatly resembles the <i>mung</i> pulse in its leaves and pods, but unlike the latter, it is a creeper and the pods</p> <p data-bbox="330 1465 453 1488"><b>P. 1410-25.</b></p>

in the Assam Valley.

(B. C. Basu.)

PULSES.

CULTIVATION  
IN ASSAM.

are thin and long resembling needles more or less, from which fact the plant derives its distinctive name of *hija* or needle pulse.

The seeds are also elongated and of a pale yellow colour not unlike that of the Bengal *sona-mug*. A black-seeded variety is also said to be known, but it must be comparatively rare.

The plant is an extensive creeper. The usual mode of growing it is to dibble in the seeds at short intervals along the fences put up around sugar-cane fields and allow the plants to creep over them. The crop is also grown in mixture with *dhu* rice in the same way as the *soy-bean*. May and June are the proper months for putting down the seeds, and the plants begin to bear about six months later. They continue to flower and fruit all through the cold weather, the pods being plucked from time to time as they become ripe. Delay in plucking may cause the pods to burst and shed their seeds. A large creeper may extend along the fence for many yards on either side, and it is said a single plant may yield up to 5 seers of pulse.

The green seeds may be eaten raw or used in vegetable curries. Ripe seeds are also used as *dal*. The pulse has an unpleasant fishy smell about it and is not much liked.

# PĀTĀNI JOKRĀ.

## *Glycine hispida*, Maxim.

English name—Soy-bean.

Bengali name—*Chhāi*.

Soy-bean is little known in the Assam Valley. The Barpeta subdivision is the only part of the valley, from which its cultivation has been reported. The pulse is, however, extensively grown in the Khasi Hills. In Barpeta the crop is sown mixed with *dhu* in April and May. About 5 seers of seed are sown per acre. The *dhu* crop is removed in July and August, but the bean crop remains on the ground till December or January. The *dhu* stubble acts as support to the bean plants. About November it puts forth its blossom. The crop becomes ready for the harvest in December and January. The mode of harvesting it and its subsequent treatment and use are precisely the same as for *kulhi-mih*. The crop is grown entirely for home consumption.

GLYCINE  
HISPIDA.

The  
Soy-bean.

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AQUILARIA AGALLOCHA.

(EAGLE OR ALOE WOOD.)

[*Dictionary of Economic Products, Vol. I., A. 1251-8.*]

*Notes on the Collection of Agar in Assam and Burma, and on the preparation of the bark as a writing material. By DAVID HOOPER, Curator, Indian Museum, Calcutta, Industrial Section.*

The present number of the "Agricultural Ledger" deals with the collection and trade of agar wood, and the preparation of the oil as practised in Assam and Burma. An account of the peculiar use of the bark as a writing material instead of paper is also given. This use was noticed by Mr. E. A. Galt, Honorary Director of Ethnography in Assam in 1894, and the Reporter on Economic Products to the Government of India, instituted an enquiry into the subject to which the Deputy and Assistant Commissioners have willingly responded, and contributed valuable notes on the Habitat, Vernacular names, Resin, Bark, Oil, Medicines, Perfume, and Timber of this tree.

It is not intended in this article to give the History of Lign aloe or aloes wood, or refer to the innumerable quotations regarding *agaru* met with in ancient writings. These may be found, by those interested, in the Pharmacographia Indica and the article in the Dictionary of the Economic Products of India.

*Aquilaria Agallocha, Roxb.; Fl. Br. Ind., V., 199; Ind. Kew., I., 166.*

THE EAGLE OR ALOE WOOD TREE.

Vern.—*Agar*, HIND.; *Agaru, ugar*, BENG.; *Agaru, lauha*, SANS.; *Agar-hindi, ud, and, ande-hindi, éde-hindi, agalugen*, ARAB.; *Agar-hindi, agar*, PERS.; *Uâ, ud farsi*, PB.; *Agara hindiagara*,

INTRODUC-  
TION.

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**AQUILARIA  
Agallocha.**

## Notes on the collection of Agar

**EAGLE-  
WOOD.**

BOMB.; *Agar*, GUJ.; *Agar*, *aggalichandana*, TAM.; *Krishna agaru*, *agui*, *kashamu*, TEL.; *Sasi*, *sachi*, *bislat*, ASS.; *A-kyau*, BURM.; *Kihay sinnah*, SINGH.; *Kaya garu*, *garu* MALAY; *Krisana*, *mwahmi*, SIAM.; *Tsanah*, SELUNG; *Nyau-chah*, *ngacha*, *chén-tiang*, CHINESE.

The name of the wood is *Lignum aloes*, Pao Daguila-aloes wood, from the Malayalam word *agil*, Kulambak, *aguila* wood (*Linschoten*), Calamba, Aggar, Tugge, *Agallochum Xylo* or Paradise wood. The meaning of the Chinese name is "fragrancy sinking under water" and alludes to the heaviness of the wood (*Bretschneider*). The same character of the wood is indicated in the Sanskrit name *garu* = heavy.

The word *aloes* probably comes from *lauha*, a Sanskrit or Pali word, by transposition not uncommon in Hebrew literature. Others suppose the name to be a corruption of the Arabic term *Al-dd*. The wood has no connection with the bitter extract obtained from the leaves of species of *Aloe*.

**Habitat.**

**Habitat.**—Roxburgh says the *A. Agallocha* is an immense tree, a native of the mountains east and south-east of Sylhet, between 24° and 25° north latitude.

The tree grows in Cachar, Sylhet, Darrang, Jorhat, Sibsagar, Manipur, and the Khasia, Garo, Mikir and Naga Hills in Assam. As a tree of Bengal, it occurs in Tipperah. In Burma it is found in considerable quantities in Tenasserim, specially about the Lenya and Maliwon townships, and on the islands of the Mergui Archipelago. Kurz states that it is found on the Martaban Hills east of Taunghu. In Assam the tree prefers high or "tillah" land at an elevation of over 500 feet above sea level, and in Burma it grows freely in ever-green forests on sloping hills. It attains a height of 60 or 70 to 100 feet, and a girth of 5 to 8 feet. The tree is fit to be cut down for agar collecting at 20 years, but others consider it is not mature enough until it is 50 or 60 years old. The flowers appear in March and April, and the fruit ripens in July and August.

**Collection.**

**Collection of the Agar.**—The wood of *Aquilaria Agallocha* in its ordinary state is not of much value, being pale in colour, light and inodorous. But under certain conditions a change takes place in both trunk and branches, the wood becoming gorged with a dark resinous, aromatic juice, and acquiring a greater specific gravity. These portions of the wood are collected and constitute the drug called *agar*, which is esteemed the more in proportion as it is ponderous and abounds in resinous matter. In no other part of the tree is this fragrant resin deposited.

"In Sylhet, the collection of aloes wood is a precarious and tedious business; those engaged in it proceed some days' journey into the hilly districts, where they fell any trees they find, young or old, and

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in Assam and Burma, etc.

(D. Hooper.)

**AQUILARIA  
Agallocha.**

then on the spot search them for the *agar* deposits. This is done by chopping off the bark and into the wood until they observe dark coloured veins, indicating the proximity of wood of valuable quality, which generally extends but a short distance from the centre of a trunk or branch. In this manner a whole tree is searched through, the collectors carrying away only such pieces as are rich in odoriferous resinous matter. In some districts it is customary to facilitate the extraction of the resinous wood by burying portions of the tree in moist ground, or by allowing the entire tree to remain a length of time (one to three years) after it is cut down, the effect of which is to cause decay in the non-resinous wood and thus render it easily removable by an iron instrument" (Hanbury).

Were the wood less soft than it is the labour of procuring this substance would probably exceed its worth, since, there being no external diagnosis, each tree has to be cut down to discover the resin. Sometimes the resinous deposit is found in one out of every dozen trees, and only one in a hundred will yield a rich wood. If the resin should exist the vein will most likely be found cropping up at a point eight or ten feet below the lower bough, on the other side of the bend, if there be any; from here it is followed down as far as it exists or as it is considered necessary. The average yield of a mature tree is three to four seers.

Occasionally, but very rarely, a tree is met with that contains as much as £300 worth of *agar*, in this case the entire substance of the tree, from almost immediately under the bark, becomes converted into *agar* for a considerable way up, so that a single blow of the axe lays it open.

It is a difficult matter to decide what is the predisposing cause of the secretion of this peculiar oleo-resin. It is not old age as it is frequently found in young trees, and though it becomes concentrated in old trees the secretion makes its appearance at an early age. No fluid resin exudes from the trees naturally, and in Jorhat several trees were specially tapped but no drop of secretion made its appearance.

The formation of the deposit is often referred to disease or decay, but Mr. C. Brownlow of Cachar, writing in 1863, says it is no sign of decay or unhealthiness as the tree apparently continues to thrive as well as the others, and if the parts affected be examined it will be found that there is no hollowness or unsoundness, but that the woody fibre is perfectly sound and merely impregnated or soaked to a greater or less extent with resin.

COLLECTION.

Variable  
content of  
resin.

Causes of  
the deposit.

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**AQUILARIA  
Agallocha.**

## Notes on the collection of Agar

**COLLECTION.**

The balance of opinion among Forest officers is that the *agar* is usually, if not always, found where some former injury has been received.

Mr. Brownlow also states that in the male trees only, or as the natives call them *moones*, the resinous substance is to be found, and it is vain to look for it in the fruit-bearing or female trees of the same species.

**Agar-  
kumlahs.**

The collection of *agar* in Sylhet is carried on by a class of men called *agar-kumlahs*, who are obliged to go considerable distances to find the trees in sufficient numbers. The indigenous population does not trouble to collect the resin. There is no special season for collecting the wood since this depends entirely on the convenience of the collectors. The *kumlahs* frequently start in bands by boats up the valleys taking as much as three months' provisions with them, and well equipped for a long stay in the jungles. The most experienced *agar-kumlahs* are from Pertabghur in the valley of the Lun-  
gleh.

**Collection in  
Burma.**

In Burma, *Akyau* is known in the islands below Mergui, and is collected by a race of nomadic sea gypsies, the Selungs or Salones. Mason informs us that these people are very reticent about the distribution of the tree and the collection of the resin and endeavour to keep all other tribes ignorant of the extent of the trade.

**DESCRIP-  
TION.**

**Description.**—The drug occurs in pieces of extremely irregular shape and size. The largest rarely exceeds a pound in weight, while some of excellent quality is met with as small chips or splinters. The largest pieces have been scooped and trimmed with great care, so as to remove as far as possible all the less resinous portions. The lighter portion of wood called *doom* is the cheapest and is sold for R1 to R3 a seer, the black or brownish-black is the true agar of commerce and is called *ghurkee*, and worth from R16 to R20 a seer. This wood is marked more or less distinctly with innumerable coarse parallel veins loaded with dark resinous matter, and in the interior of the thicker portions hollow spaces are sometimes evident. The wood has a slightly bitter aromatic taste; its odour is peculiar and not remarkably agreeable; some persons compare it to sandal-wood, others to ambergris. When a splinter is held in the flame, the resinous matter melts and burns with a bright flame or smoulders and gives off a pleasant smell of incense.

Spirits of wine separates the aromatic resin from the woody fibre. A good sample yielded Hanbury 48 per cent. of matter soluble in rectified spirit. The spirit extract forms a deep reddish-brown solution which produces a milky emulsion when mixed with water.

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in Assam and Burma, etc.		(D. Hooper.)	AQUILARIA Agallocha.					
<p><b>Substitute.</b>—A heavy, dark coloured, straight grained, oily and resinous wood, the botanical origin of which is unknown, is imported into Bombay and Calcutta from Zanzibar. It is called Sagar-Tagar, Tuggur or Taggar wood, and is frequently offered as a substitute for the agar of Assam. Like agar it sinks in water, but is recognised by giving a yellow colour to the water which develops a greenish fluorescence. This wood is sent to Delhi, Lucknow, and other large cities of Northern India, where it is distilled with other ingredients to form some of the compound attars so much esteemed by the natives.</p> <p><b>Commerce.</b>—In India the collection of agar is under the control of the Forest Department, and the article itself is included in minor Forest Produce. The trade is necessarily a fluctuating one, and the following statistics will be of interest as indicating the amount and value of the wood exploited.</p> <p>In 1892 it was reported from Assam that the produce from the <i>Aquilaria Agallocha</i> has hitherto been found in the districts of Sylhet and Cachar, and in the former the local capabilities were so overworked that it was considered necessary to give the forests a rest, so that no revenue that year was derived from them. In Cachar also the <i>mahal</i> was not sold for that year. Quite recently, however, the <i>agar</i> tree has been found in fair quantity, according to report, in the submontane forests of Sibsagar and the Naga Hills; and enquiries for permission to work out this produce having been received from several persons, it is anticipated that a larger revenue than hitherto may be realised from this item in future.</p> <p>The forest revenue from <i>agar</i> during the last eight years shows a decided expansion in the trade, although in 1897-98 it was reported that the trees were becoming scarce and more difficult to find.</p>			SUBSTITUTE.					
			Taggar wood.					
			COMMERCE.					
			Trade in Assam.					
1894-95.	1895-96.	1896-97.	1897-98.	1898-99.	1899-1900.	1900-01.	1901-02.	
R	R	R	R	R	R	R	R	
739.	2,831.	1,395.	424.	1,503.	1,929.	2,765.	4,434.	
<p>These amounts were contributed from the districts of Sibsagar, Darrang, Sylhet, Cachar, and Manipur.</p> <p>The wood is sold by the maund (= 82.3 lbs.) or by the basketful. The royalty per maund is one rupee or somewhat less, and by the basket about Rs. 8.</p> <p>The Assam <i>agar</i> is sent to Calcutta where it is sorted by the merchants, who in turn sell it to Muhammadans in Turkey, Arabia, and Persia.</p> <p>In Bombay there are two kinds of aloes wood, the <i>Mawadi agar</i> derived from <i>A. Agallocha</i> and the <i>Gaguli agar</i> from <i>A. malaccensis</i>. It sells in the bazar at Rs 8 to Rs 12 a pound according to</p>								Royalty.
								Trade in Bombay.

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**AQUILARIA  
Agallocha.**

## Notes on the collection of Agar

**TRADE.** quality. Irvine records the fact that it sold in Patna fifty years ago at Rs 2-8 per pound.

In England Eagle-wood is stated to bring about £30 per cwt. for 1st quality (Sumatran); £20 for 2nd quality (Malaccan); and £2 10s. for 3rd quality (Malaccan and Indian chips).

**Burma.** With regard to Burma the produce has been extracted from the islands of the Mergui Archipelago for many years, and no tax appears ever to have been imposed till recently. The average value of exports from Mergui port for the last three years ending 1898 has been Rs 9,000, this does not of course include large quantities removed direct from the islands by Chinese boats and *kaltus* to Penang and Rangoon.

As long ago as 1876 Mr. Lee stated that 8,000 trees were cut annually for the purpose of obtaining this substance. These figures perhaps are exaggerated, but there is no doubt large numbers were cut. The Selungs are said to collect about 1,000 viss a year (1 viss = 3.65 lb), most of which goes to China and Siam.

In 1870 *akyau* was worth from Rs 5 to Rs 22 per viss. In 1881-82 the prices had risen to Rs 50, and in 1898 the wood was worth Rs 60. A sample weighing 30 tolahs, purchased from a forest contractor for the Indian Museum, Calcutta, cost Rs 20. In Rangoon where it is valued both for the preparation of medicine and perfume, it sells for two rupees per *tikka* (a *tikka* is the weight of one rupee). The demand is met entirely from Mergui.

**Malacca  
aloes wood.** At the Paris Exhibition in 1878 a specimen of aloes wood was shown from Cochin China, and its botanical origin was referred to *Aquilaria malaccensis*. The wood is highly prized at Saigon where it is known as *iramtoe* and costs not less than 34 francs the kilogramme (2.2 lbs.).

In the sixteenth century, according to Van Linschoten, the best Palo Daguiello and Calamba were said to grow in Malacca and Siam, and were probably the produce of *A. malaccensis*.

**USES OF  
AGAR.** **Uses.**—From ancient times *agar* has been used all over the East for its perfume and its supposed medicinal qualities. On account of its portability and great value, one of the petty Rajahs of Assam used to send his tribute to the Viceroy, during the Muham-madan rule, in this substance. At one time it was sold by weight against silver and gold. In the present day aloes wood is used largely in China, where it is consumed as incense and in the manufacture of joss-sticks. It is, however, to be met with in Eastern bazars, including those in Syria, where Hanbury found it for sale. In Sylhet a certain quantity is collected each year for the sake of extracting from it a sort of essential oil (*agar-allar*) which is regarded as costly as otto of roses.

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in Assam and Burma, etc.	(D. Hooper.)	AQUILARIA Agallocha.
<p>In Bombay <i>agar-batis</i> or <i>agar</i> lights are made of various sweet smelling articles of which aloes wood is the chief ingredient. These substances are mixed with gum benzoin, and a little oil, and rolled into sticks. The sticks are then burned as incense or used as perfume. The price varies from 8 annas to Rs the pound according to the composition.</p>		USES.
<p>Woods of this odoriferous nature are used for making beads, rosaries and crucifixes, and the enduring quality of the wood, due to the balsamic resin, renders it an efficient component in mixtures used for embalming the dead. Van Linschoten records that Eagle-wood is much esteemed by Hindus "to burn the bodies of their Bra- menes and other men of account, when they are dead, and because it is costly, therefore it is a great honour to those that are burnt therewith as it is to those that with us are buried in tombes of marble stones."</p>		Embalming
<p>The wood is a preventive against fleas and lice, and in the form of a powder is rubbed into the skin and the clothes. In medicine aloes wood is considered a stimulant and cordial in gout, rheumatism and paralysis, also as a stimulant astringent in diarrhoea and vomit- ing. It is taken internally as a tonic in doses of ten to sixty grains. Under the name of <i>agalocki</i> Celsus ranks it among medicines which invigorate the nerves. The wood has long had a place in the <i>Materia Medica</i> of the <i>Pharmacopœias</i> of Europe, but it does not appear to possess any properties that call for its admission to modern local practice.</p>		Medicinal uses.
<p><i>Agar-attar</i>.—The <i>attar</i> of agar is prepared at the villages of Srya- nagar and Rajinagar in Karinganij in the following manner. The wood employed in the manufacture is that of the lowest quality which is worth from Rs 1 to Rs 5 per seer. The <i>agar</i> is fine cut into small pieces (<i>chura-agar</i>) and is then further reduced by pounding it in a <i>dhenki</i> or mortar; the circular band of iron on the lower part of the <i>siya</i> or pestle is indented, and this facilitates the disintegration of the <i>agar</i> as it is worked up and down. The powdered wood is then placed in a copper vessel called a <i>deg</i> which serves as a still and is fixed perma- nently over a furnace. A basketful of agar dust with 3 to 3½ maunds of water will about fill the still to within six inches of the top, and this is the usual charge. The copper still-head called a <i>sarposh</i> to which a tube 5 inches in length is attached, is then fixed on the <i>deg</i> and securely luted. A delivery tube (<i>kham</i>) bent at right angles con- nects the head of the still with a bamboo <i>chungi</i>, the latter is wrapped round with gunny cloth and acts as a condenser. The <i>chungi</i> leads into another copper vessel called a <i>barupa</i> or receiver. This receiver is kept immersed in water contained in an earthen vessel called a <i>mārna</i>, for the purpose of cooling the condensed liquor and prevent- ing loss of oil. The furnace is lighted, and a slow fire is maintained</p>		The attar of agar.
		Preparation.

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**AQUILARIA  
Agallocha.**

## Notes on the collection of Agar

**AGAR-ATTAR.**

till the evening, when the *barupa* will contain the distilled water, mixed with *attar*. Next morning the liquid is poured into a dish, and the *attar* floating on the surface of the water is removed by the hand or by means of a mussel shell.

On the first day *attar* to the extent of 2 to 5 tolas is obtained, the amount varying according to the quality of the *agar* wood employed, if of a very bad quality only half a tola is obtained. On the next day, the water from which the *attar* has been removed, is returned to the still and more water added until within 6 inches of the top. The distillation is then continued as before when about half the quantity of *agar* will be obtained. The same process is repeated the third day when only  $\frac{1}{2}$  or  $\frac{1}{4}$  of a tola of *attar* is separated. The price of the *attar* in Assam is Rs 3 per tola. The refuse in the still is sometimes sold for Rs 3 to Rs 5 a maund. When 20 tolas or more are obtained, it is purified and is sent to Calcutta for sale.

**Wood.**

**Wood.**—The timber is very light, yellowish-white, soft straight-veined and fissile. Some pieces are closer grained and take a pale-brownish polish. The wood is perishable, but from large trunks dug-outs are sometimes made which with care last for two years. Karens make bows of the wood. The timber though soft is difficult to saw owing to its excessive woolliness.

Brownlow informs us that the Tugger tree is possessed of great vitality and a wonderful power of renewing its bark even when the latter has been scorched off by fire. He says "The wood is disposed in concentric layers which easily separate and should, owing to any cause, the upper layer be splintered or detached, the bark leaves it outside and forms itself on the second layer. Although the wood itself is very perishable and rots completely in one year, the parts that are impregnated with the peculiar resinous substance are protected from decay and last as long as the most durable timbers; hence any *agar* there may be present is easily disengaged a year after cutting over the trees."

Gamble says "Pores small and moderate-sized in short radial lines. Medullary rays fine, numerous, the distance between the two consecutive rays less than the transverse diameter of the pores. Numerous short transverse bands of pores as intercellular ducts filled with a brownish substance."

The growth is moderate, 8 rings per inch of radius. Weight: Kyd gives 20lb; Gamble's specimen was 25lb per cubic foot. Kyd gives P = 203.

**Paper  
Material.**

**Paper Material.**—Mr. E. A. Galt, I.C.S., who was Director of Land Records and Agriculture, Assam, in 1894, drew attention to the fact that the bark of *Aquilaria Agallocha* affords a natural

**A. 1251-8.**

in Assam and Burma, etc

(D. Hooper.)

**AQUILARIA**  
**Agallocha.**

**PAPER**  
**MATERIAL.**

paper that appears to have been used for ages by the aboriginal tribes of Assam, like the birch bark of the Aryans. The information is found in a paper on the "Abstract of contents of one of the Ahum Puthis" (*Journal Asiatic Society, Bengal*, Vol. LXIII, part 1, No. 2, 1894), written when Mr. Galt was Honorary Director of Ethnography in Assam. The foot-note to the article reads as follows:—

"The *sachi* tree is the same as that known in Bengal as *agar*, the aloes wood of the Bible, from which are obtained the perfumed chips which are so largely exported from Sylhet for use as incense in temples, etc. Although its bark was widely used as a writing material throughout Assam, prior to the introduction of paper, its employment as such seems to have escaped notice.\* The following description of the manner of preparing the bark for this purpose, for which I am indebted to Babu Phani Dhar Chaliha, of Sibsagar, may therefore be found interesting. A tree is selected of about 15 or 16 years' growth and 30 to 35 inches in girth, measured about 4 feet from the ground. From this the bark is removed in strips from 6 to 18 feet long, and from 3 to 27 inches in breadth. These strips are rolled up separately with the inner or white part of the bark outwards, and the outer or green part inside, and are dried in the sun for several days. They are then rubbed by hand and on a board, or some other hard substance, so as to facilitate the removal of the outer or scaly portion of the bark. After this they are exposed to the dew for one night, the next morning the outer layer of the bark is carefully removed, and the bark proper is cut into pieces of convenient size, 9 to 27 inches long and 3 to 18 inches broad. These are put into cold water for about an hour and the alkali is extracted, after which the surface is scraped smooth with a knife. They are then dried in the sun for half-an-hour, and when perfectly dry are rubbed with a piece of burnt brick. A paste prepared from *mdlimdh* (*Phaseolus aconitifolius*) is next rubbed in, and the bark is dyed yellow by means of yellow arsenic. This is followed again by sun drying, after which the strips are rubbed as smooth as marble. The process is now complete and the strips are ready for use."

Preparation  
of bark.

From another description we learn that there is no fixed season for removing the bark from the tree, but it is taken away whenever required. In Golaghat the paper is prepared by scraping both the outer and inner surfaces of the *sachi pdi* first with a *dao* or knife and then with pieces of burnt brick. When the pieces are sufficiently thin they are boiled in water, after which they are dried in the sun

Another  
description.

\* Lowrie observed that from the bark of the tree, probably *A. malaccensis*, the common paper of the Cochin-Chinese was made. (Ed.)

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**AQUILARIA  
Agallocha.**

Notes on the collection of Agar in Assam and Burma, etc.

**PAPER  
MATERIAL.**

They are finally polished and coloured either with *harital* (sulphide of arsenic) or *hengol* (sulphide of mercury).

Mr. W. Robinson, of the Gowhatti Government Seminary, said in 1841: "The bark is cut up in long strips by the natives and used as a substitute for paper: their *buranjis*, or chronicles, are usually made of it."

Mr. J. W. Masters, writing in 1843, says the bark may be stripped off in large pieces without much injury to the tree; it is used to write on and for various other purposes, and makes a very strong and durable paper.

**Appearance  
of the bark.**

The natural bark of the tree is tough and pliable, grey on the outside with a thin corky layer and light buff coloured on the inner surface. The liber consists of long white silky fibres of great strength, and resemble those found in *Mezereon* and *Lasiosiphon* bark of the Natural Order *THYMELIACEÆ*. The pieces of prepared bark are in flat strips of various sizes from  $22 \times 4\frac{1}{2}$  to  $8 \times 2\frac{1}{2}$ , the latter appears to be the ordinary size for the leaves of the books, a hole passing through the centre allows a string to hold the leaves in position. Some of the pieces measuring  $16 \times 4\frac{1}{2}$  inch had merely to be divided into four parts to make the ordinary sized leaves. These smaller pieces had on them a broad border of red pigment while others had an artistic floral design. On one large piece of the bark was depicted a battle scene, one warrior seated on an elephant and the other in a chariot, the weapons of warfare being bows and arrows. It has been recorded that this bark is used for the preparation of sacred documents. Brahmins and Goshais in the habit of performing religious ceremonies in the houses of their disciples or in the presence of the gods in the temple, consider it impure to have their *mantras* written on mill-made paper and therefore retain the custom of writing their sacred books on the prepared bark of the *sachi* tree. This rule, however, is not strictly adhered to, as one specimen of the bark from Sibisagar, prepared as the leaf of a book, consisted of a part of a Sanskrit grammar giving the inflection and tenses of certain verbs. The prejudice of the Hindu mind against paper made from old rags will long remain, notwithstanding the detergent action of alkali before they appear in the finished paper. The cost of bark paper compared with that made by machinery is considerable, and although *sachi puthis* have so long been in use in Assam, we have it on the authority of one of the Assistant Commissioners that the bark of the tree as a writing material has now-a-days become rare as the people have recourse to mill-made paper.

**Used for  
sacred  
documents.**

Besides forming the leaves of books the bark is sometimes used as covers for binding books. The Nagas and other hill tribes prepare strips of the bark by which they hang their baskets on their foreheads. The fibre is used for making ropes, but it is not very lasting.

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G. I C. P. O.—No. 77 R. E. P.—30-4-1904—2,250 - B. N. D.

THE  
AGRICULTURAL LEDGER.

1904—No. 12.

**AQUILARIA  
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## AGENTS.

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Messrs.	Messrs.
E. A. Arnold, 37, Bedford Street, Strand,	Kegan Paul, Trench, Trübner & Co.
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Constable & Co., 2, Whitehall Gardens,	Bernard Quaritch, 15, Piccadilly,
London, S. W.	London, E.
P. S. King and Son, 2 & 4, Great Smith	Williams and Norgate, Oxford.
Street, London, Westminster, S. W.	Deighton Bell & Co., Cambridge.

### ON THE CONTINENT.

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Thacker, Spink & Co., Calcutta and Simla.	Superintendent, American Baptist Mis-
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G. A. Natesan & Co., Madras.	N. B. Mathur, Superintendent, Nazair-
	kanun-Hind Press, Allahabad.

(Vegetable Product Series, No. 27.)  
(Dyes and Tanno.)

THE  
AGRICULTURAL LEDGER.

1904—No. 12.

BIXA ORELLANA.

THE ANNATTO-DYE PLANT.

[*Dictionary of Economic Products, Vol. I, B. 523-38.*]

ANNATTO DYE.

*A Review of existing information. By I. H. BURKILL, Officialing Reporter on  
Economic Products to the Government of India.*

*Bixa Orellana, Linn.; Fl. Br. Ind., I., 190; Ind. Kew., I., 309.*

THE ANNATTO OR ARNOTTO DYE.

**Vern.**—*Lakkan, lotkhan, wakkana*, HIND.; *Kong knobhi*, SANTAL;  
*Jarat, jalandhar*, ASS.; *Giltas*, URUYA; *Powasi*, CHITTAGONG; *Keipom*,  
*wri-rom*, MANIPUR; *Shil-k-pandú-ká-jár*, DUK.; *kisri, kesari, kesuri*,  
*sendri or shendri*, MAR.; *Jáphara-chettu, japhra-vittulu-chettu, kurungu-*  
*mánji-vittulu-chettu*, TEL.; *Japhra-maram, japhra-virai-maram, kurungu-*  
*manjit-virai-maram*, TAM.; *Kappa-mankala, rangamali, rangamali-*  
*lannu* (the fruit), KAN.; *Thilin*, BURM.

**Habitat.**—Annatto or Arnotto is a dye obtained from the coating of the seed of an American shrub or small tree known as *Bixa Orellana*. It is a plant easily cultivated, is not very exacting in the matter of soil, and has been taken to nearly every country of the Tropics. The flowers are showy, sometimes white, sometimes pink; and often it is grown as an ornamental plant in gardens. Swampy ground it does not like, and the least frost is prejudicial: otherwise the plant is ready to accommodate itself to most conditions found within the Tropics where the rainfall is 50-60 inches.

The plant grows to a height of 12-15 feet.

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BIXA Orellana.	Annatto.
HABITAT.	<p>The leaves are heart-shaped, sharp at the end, and even at the sides rather like those of the common lilac of gardens in England. The flowers are borne at the ends of the branches in a loose bunch and are large, regular and showy. The pods are rather urn-shaped in general outline, laterally compressed and slightly beaked above; they are covered with weak prickles. At full maturity they crack open from the beak downwards, along the two edges and expose the seeds. The Annatto harvest begins when two or three of the pods of a bunch are gaping slightly: then is the time to cut off the whole and to take them to any suitable place for shelling out the seeds. These seeds are either dried carefully in the sun and sent into the market as they are, or else the dye is prepared from them by one of the processes to be described.</p>
CULTIVATION.	<p><i>Cultivation.</i></p> <p>The cultivation of <b>Bixa</b> is very simple; and the bush has few enemies. The first return comes in the second year.</p> <p>Seeds from which the dye may have been washed are sown at the beginning of the rains about 7-8 feet apart in prepared soil. Two or three seeds may be put into each hole and ultimately the weaker seedlings eliminated, or else the seedlings may be grown in a nursery and planted out at the distance named. On the fattest lands the intermediate plants may ultimately have to be removed, so that the bushes may stand 15 feet apart. As the young plants come up a little shade is given either by placing large leaves over them to protect them during the heat of the day, or by putting mats over them. When they are a foot high they may be considered to be established and need no further shade. Weeding is necessary until by their own growth they so cover the ground as to keep weeds down. Pruning is desirable to make the plant bushy; for the flowers are borne on the ends of the branches.</p> <p>Annatto plants make good hedges and may be used for wind breaks for other kinds of cultivation.</p>
YIELD.	<p>The yield per acre is set down at <math>6\frac{1}{2}</math> to <math>7\frac{1}{2}</math> maunds of seeds and as 9-10 seers of seed will give one seer of the prepared dye, it is 26 to 30 seers of dye. The first full crop may be set down at 5 cwts. (4 mds.) of seed per acre; the subsequent crops increasing.</p> <p>The parts of India with rainfall suited to its cultivation are Lower Bengal, Dacca, Mymensingh, almost all Assam, the hill regions over Orissa, the Burmese coast, and North Burma, the coast south of Bombay and the lower hills of Southern India.</p> <p>Of Ceylon the greater part of the island is suited to its cultivation, and an extensive plantation under European supervision exists at Matale.</p>

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Annatto.

(J. H. Burkill.)

BIXA  
Orellana.

CULTIVA-  
TION.

Except for the coast south of Bombay, I have evidence that the plant already exists in all parts of India suited to it; but the pink-flowered form seems to be the better kind and it is not always the one already growing.

The Dye.

THE DYE.

The outermost coat of the seed is the part which contains the dye. The dye principle is a chemical body known as Bixin, isolated as glistening red crystals and examined by Zwick (*Chem. Zeitung Report.* 24, page 66) in 1900 who ascribes to it the formula  $C_{48}H_{34}O_4$ . His results agree with and complete the earlier ones of Etti.

The percentage of Bixin present in the seed coat is not very large and may be considerably less in commercial annattoes because of the admixture in them of parts of the seed—often the whole seed ground up—and of substances added in manufacture.

There are recorded, however, no recent analyses of the seed coat which might be quoted for the sake of obtaining a standard.

When Columbus discovered America, Annatto dye was used by the fierce Caribs as war paint. They called it Koncou—a name still used by the French. It is now employed chiefly to colour butter and cheese, in pharmacy for colouring some ointments and to a less extent as a dye for silk, calico, wool, sheep-skins, feathers, wax, ivory, bone, etc., and in the paint industry. The commonest tints which it is used to give are yellows—such yellows are the primrose and cowslip yellows of butter and cheese, but it can also be made to give reds. The Caribs used to make their faces and bodies crimson with it.

Uses.

The markets for it now are chiefly in Europe and North America, and the chief countries supplying it are Brazil, French Guiana or Cayenne, the French West Indies, and to a less extent the British West Indies. Ceylon and Madras also send a small quantity of seed to Europe.

The prepared dye enters the market in several forms, the chief of which are the following:—

KINDS  
IN THE  
MARKET.

- (1) as rather hard, reddish, oily, homogeneous rolls or cakes smelling somewhat like urine:—origin French Guiana (Cayenne);
- (2) similar rolls or cakes, but rather granular:—origin West Indies;
- (3) brown rolls with a pleasant smell:—origin Brazil.

The annatto of Cayenne obtains the highest price; and in France it may, sold in bulk, touch at times, 200 francs per 100 kilos. The less valuable kinds sell at much lower prices down even to 30 francs per 100 kilos. An average price in Germany seems to be about 80 marks per 100 kilos.

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BIXA  
Orellana,

## Annatto.

PRICES OF  
THE DYE.

The seeds have sold in Europe during the last years at 2½ to 4 pence per lb.

These rates translated into Indian currency and calculated per seer are—

	R	a.	p.
For best Cayenne annatto in France per seer .	1	3	0
„ inferior annatto „ „ .	0	3	0
„ average annatto in Germany „ .	0	9	6
„ seeds in London . . . . .	0	5	6 to 0 8 0

These prices bear out the remark made by Dr. H. A. Alford Nicholls in his excellent *Text-book of Tropical Agriculture* (London, 1892), page 248 : "The purer the dye is sent to the markets, the higher will be the prices obtained for it; and unless a fine article be prepared *it is better* to ship the dried seeds, from which the dye is extracted in England and the United States."

PREPARA-  
TION OF  
GOOD  
ANNATTO.

The preparation of annatto in any form is quite a simple one. The better stuff is made in the following way :—

The seeds, taken out of the capsules, are placed in a receptacle; and hot water is poured over them until they are well covered; they are then stirred for a considerable time until the colouring matter has been washed off. That done, the liquor and seeds are separated by straining through any suitable material. The former carries with it all that is of value, and is set to stand so that the dye may fall to the bottom; the latter are thrown away. When all the dye has settled, the supernatant water is poured off as far as possible, and the fine residue placed in the shade where the rest of the water may evaporate without the aid of artificial heat. As soon as the mass is dry enough to be kneaded, it is moulded by hand into rolls or cakes and these are put by until they are perfectly hard. When moulded they are wrapped in clean leaves, plantain or banana, and when dry they are packed in layers in boxes.

Brazil sends into the European market annatto in the form of rolls, but the dye is not always prepared with requisite care. The rolls weigh 50—100 grammes (4·3—8·6 tolas), and are brownish on the outside and a reddish green inside. The market knows the shape under the names of flag and roll annatto. The cakes are chiefly made in Cayenne and are called cake annatto.

The preparation proceeds for cake annatto as for roll annatto until the point is reached at which the roll annatto is moulded by hand; when instead it is cut into squares with a knife and left wrapped in clean leaves to get its last drying.

IMPROVE-  
MENTS.

An improvement upon this process is given by Sæmøer in his *Tropische Agricultur, II* (Berlin, 1900), p. 636. He says: Pour hot water over the seeds and stir as usual; then let the mass soak for

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**Annatto.**

(*L. H. Burkill*)

some days; filter off the seeds, let stand for a whole week, and afterwards pour off the supernatant water and dry.

Another suggested improvement is to use cold water and no heat in drying.

A third improvement is, use a 2 per cent. solution of soda instead of pure water for pouring on to the seeds, and to throw down the dye afterwards by adding dilute hydrochloric or sulphuric acid.

This last suggestion from a chemical standpoint is a sound one, and would seem to be in use among the manufacturers who in Europe prepare annatto from the imported seeds.

The preparation of an inferior annatto is thus done in Guadeloupe and the French West Indian islands.

The dry seeds are crushed between rollers; and the fine powder resulting, which consists in chief part of seeds and in small part of the useful seed coat, is thrown into water and allowed to settle after which the surface water is run off: the sediment is then boiled, with the lower water only, for four or five hours. After the boiling as much water as possible is squeezed out by means of boards and the remaining paste is packed into casks in layers with plantain leaves between them. This paste must be kept moist, or it will deteriorate.

As of course the stuff so prepared contains a large percentage of useless matter it fetches the low prices recorded above.

*Annatto for the paint industry.*—A specially high-priced annatto is thus prepared: the Indians of Guiana dip their hands in oil and with them wet rub the fresh annatto seeds and get a sticky mass which has to be scraped off. This mass is dried like the ordinary preparation and like it comes into the market wrapped in plantain leaves. There is but a very small demand for such material and its only use in Europe is in the paint industry. It comes into the market in little irregular shining red lumps. Gum and other substances of plant-origin may have been mixed in it as the natives like it so in order to smear their bodies with it, not by way of ornament but, so it is said, to keep away mosquitoes.

There is a supposition that a little annatto added to butter and cheese has a preservative effect, but this is very doubtful. The adding of it is rather merely to give it a colour which somehow in the English mind is associated with butter. The amount added is very small, for '03-'08 per cent. of a good preparation of annatto is all that is required to give the desired tint. Moreover, the annatto gives no taste and no smell to the butter. Nevertheless, it is said that annatto is in the Spanish Americas added to cocoa not to give it a colour but to give it a certain flavour. This fact as Semler remarks stands unreconciled to the statement that in putting annatto in butter we are doing nothing to alter the flavour.

**BIXA  
Orellana.**

PREPARA-  
TION OF  
THE DYE.  
a standing.  
b no heat.  
c precipitation  
chemically.

**PREPARA-  
TION OF  
INFERIOR  
ANNATTO.**

**ANNATTO  
AS A PIG-  
MENT.**

**ANNATTO  
IN BUTTER  
AND CHEESE.**

**THE DYE.**

**B. 523-38.**

BIXA  
Orellana.CHEMISTRY  
OF COMMERCIAL  
ANNATTO.

## Annatto.

Nearly twenty years ago Lawson reported in the *Pharmaceutical Journal and Transactions* (1885-86, page 645) upon ten samples of annatto which he had obtained in England—two Nos. 4 and 7 direct from manufacturers and the rest from dealers. Since his report no particular attention has been directed to the commercial product, and therefore we cannot cite more recent analyses.

He had five samples of red rolls which on analysis did not differ very much. The description reads as if they were flag annatto from Cayenne or the French West Indies.

The figures which he gives are as follows:—

	No. 1.	No. 2.	No. 3.	No. 6.	No. 5.
Moisture . . .	21.75	21.60	20.39	18.28	18.00
Colouring matter . . .	3.00	2.90	1.00	1.80	3.00
Extractive . . .	57.29	59.33	65.00	65.67	58.40
Soluble ash, mostly common salt . . .	13.20	12.57	7.50	11.75	10.0
Insoluble ash . . .	4.76	3.60	6.11	2.05	10.6

No. 6 was dirty, full of hairs and foreign matter, and No. 5 gave out a disagreeable odour on ignition.

Lawson remarks the high percentage of soluble ash present. In most cases it consisted of common salt which he thinks was added as a preservative and because the presence of salt heightens the colour.

He had three samples of cake annatto bought from dealers, and one, No. 7, obtained from a manufacturer. His analyses gave the following result:—

	No. 7.	No. 9.	No. 10.	No. 8.
Moisture . . .	15.71	19.33	22.50	38.18
Colouring resin . . .	5.40	5.90	9.20	12.00
Extractive . . .	26.89	23.77	28.50	20.82
Soluble ash . . .	18.50	15.00	13.80	20.00
Insoluble ash . . .	33.50	36.00	26.00	9.00

The figures are very unlike those for roll annatto in containing more colouring matter, less extractive and a large quantity of insoluble ash chiefly potassium carbonate.

Mr. Lawson also obtained a paste from a manufacturer and analysed it with the following result:—

	No. 4.
Moisture . . .	69.73
Colouring resin . . .	8.80
Extractive . . .	19.47
Soluble ash almost all NaCl . . .	2.00
Insoluble ash . . .	...

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## Annatto.

(J. H. Burkill.)

BIXA  
Orellana.CHEMISTRY  
OF COM-  
MERCIAL  
ANNATTO

This paste he got put to a practical test and  $\frac{3}{4}$  oz. coloured 60 lb. of butter satisfactorily. It was the only really satisfactory preparation among the ten which he examined. As it was very moist it is necessary in order to compare it with the others to recalculate the figures to what they would be were some 20 per cent. of water only present, whereas nearly 70 per cent. was present. Remove 50 per cent. of water from No. 4 and we get 17.60 resin, 38.94 extractive, and 4.00 ash. No single sample in the whole series comes up to this in percentage of resin. All the rolls are far inferior; they have had added to them a good deal of salt, in itself not injurious. The first three of the cakes, Nos. 7, 9 and 10, have had added to them a lot of chalky matter. Remove the ash from them and the other figures recalculated would not be unlike those of the best sample (Lawson's No. 4).

Thorpe, *Dictionary of Applied Chemistry*, vol. i, 1898, p. 174, quotes an analysis by Winter Blyth of a good annatto, wherein 28.8 per cent. of resin was found, 22.5 per cent. of ash, 24.5 per cent. of extractive matter, and 24 per cent. of water.

The conclusions are that all the red rolls contained far less colouring matter than they might and had had common salt added to them; that the cakes had got chalk or some very similar unnecessary substance in them, and that few of the preparations marketed, at least at the date at which Lawson wrote, were really good.

More recent writers, e.g., Chevallier and Baudrimont, in their *Dictionnaire des Alterations et Falsifications des Substances Alimentaires, Medicamenteuses et Commerciales*, Paris, 1897, II, p. 239, speak of the extent of adulteration but without giving recent figures which I can quote. They give directions for the testing of commercial samples by estimating the ash first and then testing the tinctorial properties by the side of a standard sample.

Lawson alleges his belief that a great deal of adulteration by turmeric was going on, but he does not prove it.

**Production of Annatto in India.**

All that can be said about the introduction of annatto into India will be found in the pages of the *Dictionary of Economic Products*. There are two forms of the plant in this country, the one with pink flowers and red pods, the other with white flowers and green pods. In 1895 Sir George Watt instituted an enquiry as to where these two forms occur in India and how. The results of this enquiry are now to be given. Wild, the white flowered plant may be found in the districts of Murshidabad, Midnapur, (Ghatal), and Raniganj, in Bengal. It also occurs about Calcutta and some places in the 24-Perganas. The colour of the flowers of the plant grown in Dacca, Chittagong

ANNATTO  
IN INDIA.  
Two  
varieties.

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**ANNATTO IN**  
**INDIA.**

**Kamela**  
**Annatto.**

and Jalpaiguri is not known to me. It was cultivated in the northern division of Dacca as a mercantile speculation before 1840 but without success. The white-flowered **Bixa** is further found in Cachar, Goalpara, Jorhat and Nowgong of Assam. The pink-flowered plant is said to be wild in Lakhimpur, Assam. The same form is cultivated in Jorhat as an ornamental shrub. In the Central Provinces in the districts of Sambalpur, Raipur, Nagpur, Chhindwara, **Bixa** is found cultivated, chiefly the pink-flowered form; and in the Chhindwara district it has run wild to a small extent. It will be noticed now that these districts border on the districts of Bengal whence the plant is reported wild. The cause of its occurrence thus would seem to be that the dyers of Murshidabad took it up as a dyeing stuff, and by encouraging its growth in this way, it being cultivated in gardens chiefly, led to its dissemination through the region from which they were wont to draw their supplies of Kamela (*Mallotus philippinensis*), the dye for which it was in some measure substituted. Nothing is more natural than that the hill people of the Uriya tracts who formerly supplied very much more Kamela to the dyers of Murshidabad than they have done for the last few decades, should take up the cultivation of the newer product demanded in its place. It is also found in Betul, I believe only in cultivation. Both white and pink-flowered bushes are to be found half wild on the hills of Vizagapatam, but chiefly the pink.

Formerly, if not still, the plant could be seen in Bombay gardens.

In Burma the cultivation of pink-flowered annatto was formerly of some extent, but now is very little; for the dye has been superseded by aniline dyes there also. The plant may be found about towns and villages, alike in the dry districts of Mandalay, Kyauksé, Sagaing, Fakokku, etc., where middle aged men remember the collecting and use of the seeds as occurring when they were children, and in the damper districts of Tenasserim, where the seeds are still a very little used and about Bhamo. Kurz remarks that it had in his time (1875) run wild in the Pegu Yomah. It is also, it seems, not an uncommon plant in Manipur.

The pink-flowered form is to be found in the Northern Shan States, e.g., at Hsipaw, and it is to be found on the Siam border, e.g., at Myawadi. In neither place is the dye now used.

In Southern India both the pink and the white-flowered bush is grown in the planting districts of Mysore and in Travancore, and the former has been cultivated on a commercial scale. In Ceylon it is commercially cultivated. The neighbourhood of Bangalore of recent years produced most of the seed shipped to England from Madras. Now the trade is moribund as the following report from Mr. J. Cameron

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of that place shows: "The Annatto plant, of which there are two local forms, has long been cultivated on a small scale about Bangalore and in some parts of the adjoining district of Kolár. But subsequent to the introduction of cheap European dyes, some years ago, the cultivation became very limited. Local plants are not in flower at present. But the enclosed drawings represented the leaves, fruit and seed in the two varieties. No. 2 (white-flowered) is cultivated more for ornament than use as the seeds are few in number and much inferior in quality to those of No. 1 (pink-flowered). The seed of the latter was formerly much valued by dyers, and is still sold in the Bangalore bazar at the rate of six seers to the rupee. I have been unable to ascertain the actual quantity produced in the local market though it is said to be very trifling compared to what it was some 25 to 30 years ago. At that time the plant (No. 1) was cultivated in villages around Bangalore. But most of the original bushes have disappeared and only a few are now found in native gardens. I think it is therefore very improbable that the so-called Madras Annatto comes from this locality. The measuring seer to which I have referred above is equal to 85 tolas, so that about 480 tolas of seed is sold for a rupee—not by any means a remunerative industry!" (Letter No. 262, dated 20th January 1904, to R. E. P.)

Mr. A. G. Castle Stuart informs me that the shrub does not occur in the north-western part of the state of Mysore, that there is very little in cultivation in the Shimoga district (apparently pink-flowered) near the villages of Muppani and Bellene, and that it is rare in the districts of Kolar, Chitaldrug, Tumkur and Mysore.

Vizagapatam sends a little seeds to Madras and to Vizianagram.

It will be best to describe, first the method of dyeing as practised in the chief centre. This centre, as already said, is Murshidabad. Roll and cake annatto are unknown. The seeds are bought in the bazar at about one rupee per seer. Two seers of water are put into a copper basin and placed on the fire to boil. When the water commences to steam half a seer of fuller's earth, *sajimali*, is thrown into it and then one-third seer of annatto seeds. After a little time has been given for the colour to be taken out of the pulp on the seeds, there is thrown into the vessel the silk thread to be dyed—one seer. Shortly the water comes to a boil and then stirring is necessary in order to prevent the silk from resting on the hot bottom of the pot. The length of time required is judged by the tint that the silk has taken. When the required colour has been got, the silk is withdrawn and put into cold water, washed, taken out, squeezed and dried in the sun. Magenta is sometimes used in combination with the annatto (Mr. E. V. Levinge, in letter, dated 23rd May 1896).

Murshidabad.

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**BIXA  
Orellana.****Annatto.****DYEING.****Ghatal.****Cachar.****Jorhat.****Nowgong.  
Raipur.  
Sambalpur.****Manipur.****Burma.****United  
Provinces.**

In the sub-division of Ghatal the same process is used. Alum is sometimes used as a mordant.

In Cachar the process is essentially the same, but the mordants are different. Lemon-juice, ash-water, and tamarinds or the fruit of *Garcinia pedunculata* are used. It is agreed that the dye is rather fleeting. It is cotton cloths which are here dyed.

In Jorhat the process in common use is as follows. The seeds are first boiled in a vessel in which plantain ashes have been mixed with water. As soon as the mixture reaches boiling point, the cloth to be dyed is immersed in it, and allowed to boil for about a minute. The vessel with the cloth still in it, is then taken off the fire, and the contents allowed to cool. The cloth is lastly taken out and dried; and a yellow dye results. The colour, however, is fleeting, and its tint varies according to the mordant used. The leaves of the *bhomrati* (*Symplocos grandiflora* or *S. spicata*) are also used as a mordant to produce a yellow dye with or without another mordant (W. A. M. Duncan, *Monograph on Dyes and Dyeing in Assam*, page 14).

Ash-water is prepared in Assam in the following way:—The trunk of a plantain tree or its root is split into pieces, dried in the sun, and then burnt to ashes. The ash thus produced is put by for future use. When required a quantity of ash is put into a thick basket and pressed down by the hand until fairly firm; then water is poured gently over it and allowed to percolate very gradually into a vessel placed underneath. The liquor is called *kharoni*.

In the Nowgong district the seeds are pounded before water is poured on to them. Also in the Raipur and Sambalpur districts of the Central Provinces the seed is pounded in a mortar before use. The same mordants are there used as have been mentioned, with the addition of curds. In the Sambalpur district the seeds may be wrapped in a piece of cloth, which is pressed and squeezed by the hand under water until all the colouring matter has gone into the water when cloth and seeds are withdrawn together. Cloth, not silk, is the material dyed in these parts. Alum may be used in conjunction with it to get a pink colour. The Sambalpur method is reported as used also in Manipur.

In Burma the process of dyeing, now all but extinct, is as described. Both silk and cotton were dyed, but now practically all of the little dyeing still done in the country by Burmans and Talaings is done with imported dyes.

In the United Provinces and in the Raipur district of the Central Provinces, butter and curds are dyed with annatto.

In Bangalore seeds from pink-flowered plants were, says Mr. J. Cameron, sold at six seers to the rupee.

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The cost of seeds in the Sambalpur district is about Rs-6-6 per seer. The cost of prepared seeds is about Rs 1 per seer in Murshidabad and Raniganj. They are quoted at twelve annas to one rupee per seer in Ghatal, Midnapur district, and at Rs-8 per seer in Cawnpur.

**DYEING  
METHODS.**

**PRICE OF  
ANNATTO  
SEEDS.**

I wish particularly to point out that at these rates annatto seed is sold in London cheaper than in the districts of India.

Cannot our Indian dyers be provided with cheaper annatto? It looks possible, and experimental growing is to be recommended. If instead of the desultory planting of a bush or two in garden hedges a small plot were only systematically cropped we should soon know how far the growing of annatto could be made profitable in India. Annatto, we are told, is giving place to aniline dyes because the dyers get the same effect at less cost with the latter, but then we notice that the supply of annatto seems to come to them at a too high price.

**The future of  
Annatto as  
a dyestuff.**

The possibility of exporting annatto stands on a different footing, for the home demand is a very limited one. Any great influx of stuff would cause a glut in the market.

**As an article  
of export.**

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